Fact Sheet

US Army Engineer
Research and Development Center
Waterways Experiment Station

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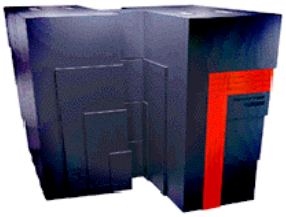
Public Affairs Office Ž 3909 Halls Ferry Road Ž Vicksburg, MS 39180-6199 Ž (601) 634-2504 Ž http://www.wes.army.mil

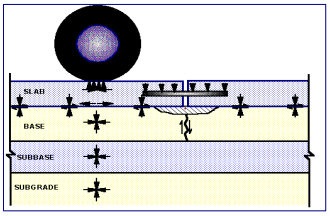
Advanced Structural Models for Pavements

Purpose: Develop improved response models for design and evaluation of rigid, flexible, and unsurfaced pavements.



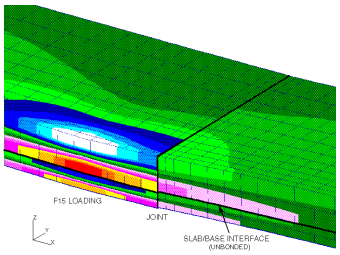
High Performance Computing

Background: Current pavement structural design procedures are based on an empirical approaches developed over the last half century. The Airfields and Pavements Division of the Geotechnical Laboratory at the US Army Engineer Waterways Experiment Station (WES) is developing advanced structural models which will permit rapid and accurate prediction of deformations, stresses, and strains in the pavement systems due to the significant loadings from aircraft and other military vehicles. The products of this research can be utilized to evaluate materials, methods, and loadings beyond the capability of current design and evaluation procedures.



Load Transfer Across the Joint

Facts: The complex nature of pavement materials and loadings requires a detailed and comprehensive analytical model to evaluate the response of a pavement to vehicle loading. The finite element method provides a powerful and general tool that permits three dimensional (3D) modeling of this complex system. The structural response models under development feature explicit 3D representations of pavement structures including joints, layer interfaces, complex material properties, and multiple-wheel loadings. With the evolution of these advanced models, it will no longer be necessary to make many of the simplifying assumptions that have limited the usefulness of classical response models such as the Westergaard and elastic layer theories.



Pavement Deflection Resulting from an F-15

Results: A general 3D analytical model for rigid pavement analysis and design has been developed which includes modeling of the joints and layer interfaces. This model has been verified against data from laboratory-scale model tests and a full-scale instrumented pavement. A general 3D analytical model for flexible and unsurfaced pavements is under development. Excellent agreement of the finite element model predictions with those from closed-form solutions has been achieved for those limited problems that can be solved in closed form. The powerful finite element method and models are currently being extended to consider a range of materials, loadings, and layer interface conditions.

Point of Contact: For more information, contact Mr. Don Smith at (601) 634-2918 or e-mail at smithd@wes.army.mil. For more information on WES, visit our web site at http://www.wes.army.mil or http://pavement.wes.army.mil.